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How to deal with the EU landing obligation: lessons from an English discard ban sea trial

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Abstract

A new EU Common Fisheries Policy (CFP) came into force on 1 January 2014. Article 15 of the new CFP basic regulation introduced a discard ban or landing obligation (LO) in EU fisheries whereby the discarding of quota species is prohibited. There is an urgent need to understand the impact of this new regulation on the UK fishing industry and fishing industries elsewhere in Europe. This study conducted a discard ban trial to provide an opportunity for the fishing industry to demonstrate what a LO would mean for them. The results are mostly illustrative and qualitative, designed to inform policy decisions and identify areas of future work to assist in the implementation of the discard ban. Five recommendations are made, which if adopted, would significantly improve the prospects of a smooth transition to a largely discard-free EU fishery.

Keywords: EU CFP, landing obligation, discard ban, fisheries management, catch data

1. Introduction

Article 15 of the new EU Common Fisheries Policy (CFP) basic regulation introduces a discard ban or landing obligation (LO) in EU fisheries whereby the discarding of quota species will be prohibited (European Parliament and Council Reg. No.1380/2013). Previously, market and regulatory forces motivated fishermen to discard their catches, whereby if the market was unfavourable catches would be returned to the sea, and if a vessel operator exhausted the quota for a species, they were legally required to discard any further catches of that species. But in the reformed CFP, the European Commission is seeking to reduce unwanted catches and eliminate discards, and quotas on total catch will place a direct cap on fishing mortality, requiring all catches (not just landings) to be deducted from the quota, and once the quota of a species is reached, fishing activities must stop. This represents a fundamental change in European fisheries policy as it switches the focus from the regulation of landings to the regulation of catches. All catches of pelagic and demersal species which have a quota will have to be landed (in the Mediterranean where there are no quotas, the discard ban will apply to all species with a minimum legal landing size). There are potential exceptions from the discard ban when these fish do not have to be landed , where the fish are prohibited for conservation reasons; or will be used for live bait; or have demonstrably high survival rates when discarded. Similarly, a small amount (*de minimis*) of up to 5% (after a transitional period of 4 years: up to 7% in years 1 and 2 of the discard ban and 6% in years 3 and 4 of the discard ban) of the total catch may be discarded if, either there are disproportionate costs of handling and storing the fish on board, or improving selectivity is proven to be difficult (European Commission 2013).

The discard ban has been phased in from 1 January 2015, when it was applied to pelagic stocks, to be extended to cover all other regulated stocks between 2016 and 2019. Unwanted catches of species which are not subject to the LO can continue to be discarded. The aim of the LO is to make fishing more environmentally and economically sustainable as fishers change their methods to maximise the revenue from their quotas. The shift of focus from the regulation of landings to that of

66 total catches brings with it the expectation that, because the costs of catching unwanted fish will be
67 internalised for fishing businesses, fishers will want to avoid catching low value fish and the most
68 quotarestricted species. For instance, in order to maximize the revenue from the catch quotas,
69 fishers will need to avoid catching fish that would result in a curtailment of their fishing season
70 (referred to as 'choke species'), and avoid catching undersized, and low-value fish, which would be
71 deducted from their quota for little or no profit. The act of having to bring the catch to shore, the
72 discard ban, is almost secondary, and was brought about through lobbying and public demand
73 (Borges, 2015), but also due to the new requirement to monitor the full catch. Consequently, the
74 latest reform of the CFP will lead to changes not only in fishing operations, but also in fish handling
75 and marketing, as previously discarded catches are brought to shore.
76
77 There is therefore a need to evaluate how the LO will impact on fishing vessels, fishing practices and
78 the economic viability of fishing fleets. Several recent studies have focused on discard bans in
79 anticipation of the implementation of the LO. For example, Condie et al. (2013) studied historic
80 observer and log book data to assess the economic impact of a discard ban on the North Sea otter
81 trawl fishery, and concluded that because vessel operators will be managed on their full catch (not
82 just landings) they will have an incentive to operate more selectivity, whereas a discard ban, in
83 isolation, generates little such incentive. Condie et al (2014b) reviewed the literature on discard bans
84 in Alaska, British Columbia, New Zealand, the Faroe Islands, Norway, and Iceland, and stated that
85 although discard bans can result in a reduction of discards, they depend on a substantial level of
86 surveillance and/or economic incentives. To further support this, another desktop study of discards
87 in the North Sea found that a discard ban in the North Sea for cod, haddock, saithe and herring could
88 offer substantial benefits, but it was the use of real-time area closures, gear modifications, and
89 electronic monitoring systems which would help ensure compliance and effectiveness (Diamond and
90 Beukers-Stewart, 2011).
91

92 Ensuring access to existing quota will be critical to the successful implementation of the landing
93 obligation (Poseidon, 2013), for example, the retrospective analysis of various fleet segments in the
94 UK, showed the potential economic impact of choke species to be very substantial (Russell et al.,
95 2015). To help with the successful implementation of the LO, the regulation also includes the use of
96 new flexibilities in quota management. These include interspecies and inter annual quota flexibility
97 mechanisms (de Vos et al., 2016) or using alternative stock reference points (García et al., 2016). The
98 importance *of* using these flexibilities has been demonstrated in simulations, for example, by
99 offsetting catches of cod against saithe, negative economic impacts could be avoided in the North
100 Sea trawl fishery (Simons et al., 2015).
101
102 Unlike these desktop and modelling studies, the current study is a bespoke sea trial carried out in
103 2012/2013 to evaluate the likely effects of the landing obligation in England, and was the first study
104 of its kind in Europe. The objective of the work was to provide practical experience of a discard ban
105 and use that to stimulate feedback from the participants to gain an insight into the direct practical,
106 and also wider implications, for the fishing industry in implementing the LO. The importance of such
107 trials was emphasised by one of the main regional stakeholder group, the North Sea Advisory
108 Council (NSAC, 2013). The aim of this study was to provide practical recommendations for fisheries
109 managers to support a successful implementation of the landing obligation.
110
111 2. Method
112 The trial focussed on how fishing practices, catch handling, storage and transport could change as a
113 result of the obligation to land all catches, and it also reported on monitoring and data issues and
114 direct economic aspects of the LO. It involved eight vessels of different sizes (four under-10m and
115 four over-10m), gear types, from different ports along the south coast of England, for up to five
116 months (Table 1). The English fishing fleet is made up of around 3,139 vessels, 83% are of length
117 10m or less, 12% are of 15m or less, and the remainder are over 15m in length; of the largest vessels

there are around 26 English registered vessels 30-50m in length (MMO, 2016). This project was initiated in 2012 before the final details of the new CFP were agreed in 2013, so although the inclusion of a discard ban was anticipated, there was uncertainty around the exact details of the policy. The trial simulated a discard ban on all commercial species - defined as species for which some part of the catch is normally landed and sold – and so also included non-quota (unregulated) species. This differs from the final agreed LO which applies only to regulated species. These differences are accounted for in the reporting of this study. A total of 128 fishing trips were conducted during the trial, of which 40 had a scientific observer on board, equating to observer coverage of 31% for the trial. All fish caught were documented using the following methods. There was 100% scientific observer coverage for the under-10m vessels, and 10% observer coverage for the over-10m vessels owing to resources limitations. The observers weighed all the unwanted catches for the under-10m vessels at the point of landing. For the over-10m vessels, catches were not weighed either by skipper or observer;; instead observed weights were estimated by converting fish length measurements from the whole catch using length-weight relationships, while the skippers simply estimated the weight from experience. The skippers' data were validated using the independent data from observed trips and data from a fishmeal plant, which received most of the otherwise discarded material.

Table 1 Details of the eight vessels participating in the discard ban trial along the south coast of England

Vessel	Vessel size	Port of landing	Gear	Fishery	ICES subarea	Months fished	Trips undertaken	Trips observed
1	11m	Brixham	Otter Trawl	Mixed demersal fish (squid, lemon sole, cuttlefish)	VIIe	Dec-Apr	38	3
2	15m	Brixham	Otter Trawl	Mixed demersal fish (squid, lemon sole, cuttlefish)	VIIe	Dec-Mar	41	3
3	23m	Newlyn, Brixham, Plymouth, Exmouth, Roscoff	Gill net	Mixed demersal fish (hake, turbot)	VIIe,f,g,h,j,k	Nov-Mar	9	2
4	24m	Plymouth	Beam trawl	Mixed demersal (sole, monkfish, cuttlefish)	VIIe,h	Nov-Feb	10	2
5-8	<10m	Hastings	Gill net	Mixed demseral fish (sole, plaice, rays, cod)	VIId	Feb-Mar	30	30

Skippers of participating vessels had to land all the commercial species they would normally discard, either due to an absence of quota, the fish being below the legal minimum landing size (MLS), or because the skippers thought it was not marketable. The new CFP regulations have replaced MLS with minimum conservation reference sizes (MCRS), below which, fish must be landed but not made available for direct human consumption markets. Any prohibited species or zero TAC species could not be landed in the trial and were recorded before being released. For each trip, skippers of over-10m vessels recorded the catch destined for the direct human consumption market, for the non-human consumption market, the reasons for otherwise discarding these catches, and the destination of this material.

Regarding the disposal of the unwanted catch, it was a condition of the trial that there was somewhere for it to be received when landed. The most suitable option was to send the material to the United Fish Industries (UFI) plant at Grimsby, UK, to be converted into fishmeal. This provided a guaranteed outlet for the discarded material. All quota species which were either under the legal size or for which there was insufficient quota to land, had to be processed into fishmeal. Although some other outlets were used for non-quota species, most of the otherwise discarded catches were sent for fishmeal. In reality, the industry will be able to access a range of non-human consumption markets to maximise profits from the previously discarded catch. The vessel owners received payment for material sent to UFI - participating vessel owners had to specify what material was being sent and where it came from, and verified that the material was suitable for use as fishmeal. This evidence is required by FEMAS (Feed Materials Assurance Scheme) to demonstrate that the material is safe to use as animal feed. Transport of the material from the ports to Grimsby was also arranged before the trial started, and was paid for by the project.

At the end of the trial, the perceptions and experiences of the participants were gathered from all skippers, market managers and managers from UFI. These discussions were based on questionnaires

with open-ended questions. One researcher conducted face-to-face interviews; the under-10m skippers were interviewed as a group. Questions were tailored to the role of the participants but included the three key broad questions (Table 2). Each interview began with a description of the proposed discard ban policy, the project objectives and a presentation of the data generated from the project. The interviews were transcribed; coded-based themes and concepts *were drawn from them*; and then a summary text of this information was produced.

Table 2 Key questions and details asked of the trial participants

1. How representative of normal fishing practice was the trial period? Topics covered: Were catch and discard patterns normal: including main species discarded, reasons for discarding, sorting practice, restrictions on landings such as zero TACs? Were any operational changes introduced during the trial: including anything to modify or avoid unwanted catches (area or gear changes), buy/lease additional quota, sell material on the human consumption or non-human consumption markets that would not otherwise have been sold?
2. What were the logistical and operational implications of the discard ban, including costs? Topics covered: How was the practical activity of your business altered? How were the fish handled, stored, and transported on shore? What was the impact on vessel/crew/staff of storing additional material? What happened when the otherwise discarded material was landed? What were the economic costs of handling the additional material? Were there safety concerns? Was it manageable?
3. What is your view on the new policy, for your business and wider implications? Topics covered: What will your business need to do to adapt to the discard ban? What will other vessels need to change? What are the economic implications and main risks to your business and to the wider fleet? What are the main challenges to successfully implement a discard ban? What must be in place to make the policy work? What could be the benefits of the policy?

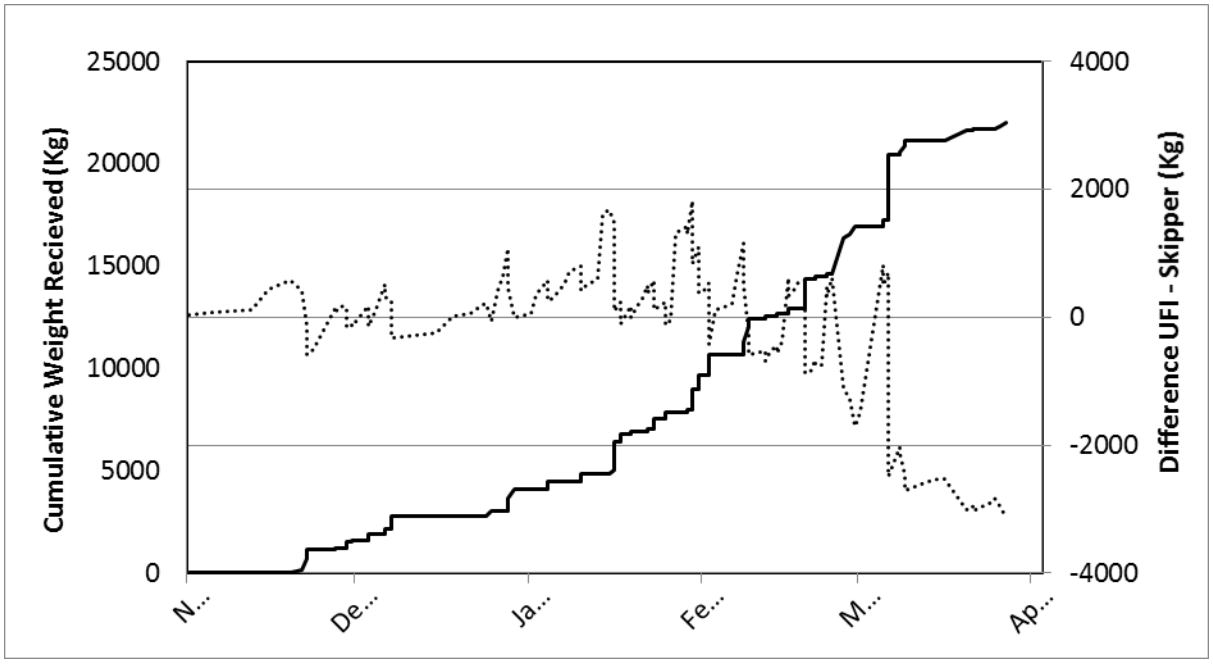
3. Results

Data validation

For the under 10m vessels, the observer-calculated weights closely matched the actual weight measurements at the point of landing (R-square 0.89; slope 0.95, linear regression), providing confidence in the length-weight relationship method to estimate weights. The results from the over-10m vessels indicate there was a trend for the skippers' estimates of unwanted catches to be slightly lower than the observers', but overall, there was considered sufficiently close correlation between the estimates (R-squared 0.85; slope 0.78) to enable the use of the skippers' data in a broader

analysis. This was reaffirmed using independent data from the fishmeal plant which recorded weights of all material received. This recording mechanism at the point of delivery of the non-human consumption material provided a useful confirmation of the skippers' reported landings. All the fish were believed to be documented, the timing of the fish arriving at the fish meal plant correlated closely to the landing of the otherwise discarded material (Figure 1), and there was a high level of confidence in the quantities and in the reported destination of those catches at first sale.

Figure 1: Cumulative weight of landed unwanted catches received by United Fish Industries (solid line) and the difference between this, and the cumulative weight of unwanted catches landed and reported by skipper (dotted line).



Discard data analysis

During the trial, the total recorded weight of unwanted catches caught by all vessels was estimated to be 27,171 kg. Of this total quantity, 70% came ashore and was sent to the fish meal factory, and 30% was released at sea. Of the catch released at sea, most (71%) could not be landed under the

conditions of the trial because the species had either a zero quota or was prohibited (mostly spurdog, undulate ray and common skate). The remainder of the catches were released because of a perceived high survivability by the skippers, and consisted of skates and ray species, and to a lesser extent conger eel, brill, turbot, and (Dover) sole. Of the unwanted catch that was landed for fishmeal, 68% was of quota species; Table 3 shows the total weight of each quota species landed during the trial and a breakdown of the reasons for otherwise discarding these fish, as given by the skipper. The *remainder* of the catch (32%) that went for fishmeal, was of non-quota species; most of which (95%) was bib, dab, dogfish and gurnards.

Species	% Damage	% Quota Restricted	% Below MLS	% No Market	Total (Kg)
Cod	48	52	0	0	3642
Dover Sole	1	1	98	0	68
Haddock	30	70	0	0	372
Herring	0	0	0	100	3
Hake	92	0	2	6	497
Horse Mackerel	0	0	0	100	65
Ling	100	0	0	0	792
Mackerel	0	0	1	99	41
Megrim	0	100	0	0	72
Monkfish	100	0	0	0	414
Plaice	0	41	43	16	3043
Pollack	100	0	0	0	723
Saithe	96	0	0	4	112
Skates and Rays	0	80	0	20	201
Whiting	4	11	13	72	2407
Total	35	30	14	21	12453

Table 3. Total weight of unwanted quota species and % contribution for each reason given for discarding

Overall, most monkfish, hake, ling, pollack and saithe that would have been discarded were unwanted because they were damaged (mostly by seals when caught in gill nets). The unwanted

herring and horse mackerel and most the mackerel were over the MLS but would have been discarded because they were not of marketable size; some of the unwanted plaice and whiting was also of unmarketable size, although above the MLS. Overall, 12,453 kg of species regulated by quotas and therefore subject to the LO (Table 3), were landed in this trial but would have otherwise been discarded, equating to 97 kg per trip (128 trips). When excluding fish discarded due to quota restrictions, which will not occur under the LO, this gives 68 kg per trip. Some of this catch was discarded due to market forces, and therefore could go to the human consumption market, or it was damaged and would not need to be landed, leaving only 13 kg of the total 212 kg of unwanted catch per average trip, which would have to be sold to a non-human consumption market. The total weight of unwanted catches that were not of quota species, was 14,764 kg, equating to 115 kg per trip and under the LO, there is no requirement to land these unwanted catches. The values presented here are not considered representative of the fleet but provide indicative values for the participating vessels. The results demonstrate that a substantial quantity of unwanted catches will continue to be returned to the sea under the Landing Obligation, however, anticipated changes in fishing behaviour and gear selectivity would likely reduce all unwanted catches.

Cost of landing otherwise discarded catches

The costs associated with *bringing* the otherwise discarded catches ashore was calculated at £280 per tonne (this included box rental and storage on market, box loading, forklift operation, refrigeration, pallet charge, ice, and transport). The total revenue of the material received by UFI had a value of £2,640, which meant the otherwise discarded catches were sold at a loss of £2,690 or £122 per tonne.

The main themes and concepts derived from the interviews are presented for each key question:

How representative of normal fishing practice was the trial period?

235 The catches taken during the trial were considered by participating skippers to be representative of
236 the period of the trial. Skippers stated that the gears that they used, and locations fished, were the
237 same as usual and no change was made to their quota holdings. They did state that discard patterns
238 can vary seasonally and under different levels of quota restriction and so results will have differed
239 had the timing of the trial been different. In total, fifteen species with quotas, and also skates and
240 rays collectively, were discarded and skippers said that the quotas for cod, plaice, haddock, and
241 Dover sole were the most likely to be exhausted first, and so could 'choke' their fisheries. Skippers
242 stated they do not target these species, *so* these catches are incidental, *but* only small catches
243 could exhaust their limited quota and prevent them from fishing. The extreme example mentioned
244 of this was for species with a zero quota, for which, under the regulation, catching a single fish could
245 close a fishery. Undulate ray and Spurdog were the species for which this issue was most important
246 for the participating vessels.
247
248 *What were the logistical and operational implications of the discard ban, including costs?*
249 Interviewees identified potential economic costs and charges associated with sorting, landing and
250 transporting the otherwise discarded fish, including:
251 • losses associated with foregone catches after cessation of fishing due to exhausting quotas
252 (choke species);
253 • losses associated with counting undersized fish (<MCRS) against quota that could otherwise
254 be used to land fish on to the human consumption market;
255 • and losses associated with reduced catches of non-limited (underutilised) quota and non-
256 quota species when changes to the gear was made to avoid quota- limited species.
257 Some direct economic benefits were also identified, including those for transport companies and
258 storage companies that will handle the previously discarded catches; and gains from selling
259 previously discarded fish on the human and non-human consumption markets.
260

Participating skippers said sorting the catch would take more time and may reduce fishing time. Health and safety implications were also highlighted, with additional sorting and moving of the catch, increased exposure of the crew to adverse weather conditions and more material stored on deck and in the fish hold. The smaller vessels on the trial were particularly restricted for space on the deck: for example, the under-10m vessels in the trial could carry only six or seven fish boxes. Similarly, it was stated that hold capacity will be a limiting factor for some larger vessels, which may have to complete more landing events to offload catches before they can continue fishing.

The trial also highlighted the risk of inadequate preparations made to receive previously discarded material at the port. The logistical organisation to receive and transport material, was done by the project team, and would otherwise not have been in place. The need to land additional boxes of fish may cause congestion at the ports, with longer periods spent queuing by vessels to land their catches. At the market auctions, the material must be moved to a storage facility, requiring staff, forklift trucks and additional refrigeration units and areas for storage bins. Material not destined for direct human consumption will need to be stored separately and physical space may not be available. With small fish coming ashore there was also a recognised risk that these could enter the human food chain.

What is your view on the new policy, for your business and wider implications?

All skippers in this trial believed the landing obligation will be extremely difficult to enforce. Vessel operators and market managers stated there was little incentive for skippers to bring unwanted material ashore. Not only will those catches be deducted from the catch quota and so reduce the quota available for the rest of the year, but the vessels will receive little economic return for the material or even make a loss when paying for disposal. Participants said the requirement to land fish that might otherwise survive if returned to the sea, would also discourage compliance with the LO.

One skipper said that if vessels arrived at the port with some undersized fish, no one would know whether that comprised all the unwanted catch.

Three skippers stated that having cameras on board was the only approach that would ensure compliance with the discard ban: other skippers were supportive of cameras in principle, but with reservations. It was believed unlikely that all vessels would have cameras on board, *and* one suggestion was for only larger vessels, those with the highest catching capability, to have cameras. Also, there was a generally low level of confidence that other EU Member States would adequately enforce regulations, and a fear that UK-vessel operators would be disadvantaged relative to those from other countries.

Beyond the direct economic costs described above, interviewees described other potential economic consequences. These included the benefits from avoiding quota limited and undersized fish, which would ultimately translate into increased stock size and quotas; and the gains from maximising revenues from adjusted quotas that will now include previously discarded catches. These are sometimes referred to as quota uplifts, and reflect the transition from landings quotas to catch quotas and are based on the level of discarding that was occurring but which was not previously not allocated as part of the quota. . These upward quota adjustments are based on independent discard estimates from scientific observer programmes.

However, participating skippers perceived a risk that the estimated discards were less than the reality. This would mean the quotas, when adjusted to include estimated discard levels, would not be sufficient to cover all the actual discards. and the fleet would need to avoid catching more fish to avoid a choke situation or to benefit from the additional quota. Some participating skippers claimed that discard data deficiencies were the highest risk in the transition to the LO, and insufficient uplift in quota could stop vessels from fishing.

312

313 Statements specifically from market managers made clear that they did not want any additional
314 burden of handling or recording non-human consumption material, because any profits for this
315 material are marginal at best. They also did not want to risk any deterioration in the quality of the
316 fish going into the human consumption market, and would consider small unwanted fish entering
317 the market as a negative impact on their business.

318

319 ## 4. Discussion

320 The discard ban trial was not an exact simulation of the LO: the trial simulated a discard ban on all
321 commercial species, which differs from the final agreed LO, in which only quota species are affected.
322 Therefore, more species and more otherwise discarded material were landed than is required under
323 the LO. However, this does not detract from the study because it was never the intention to use data
324 to forecast levels of unwanted catches coming ashore, but rather to identify key issues surrounding
325 the operational, monitoring and direct economic aspects of this change in policy. Furthermore, in
326 this trial all otherwise discarded quota species had to be utilised as fishmeal, however, with the
327 implementation of the discard ban, other outlets for the material are likely to be utilised (Mangi and
328 Catchpole, 2014), either generating a profit or reducing the losses incurred.

329

330 The discard ban trial has provided the following six lessons about how the LO would affect the
331 fishing industry:

332 1) There are reasons to be optimistic about the economic impact of the LO.
333 2) Issues of data inadequacy must be overcome.
334 3) Enforcement of the landings obligation will require new modes of management.
335 4) The problem of quota inflexibility must be resolved.
336 5) Dealing with the unwanted catch at sea and on land raises several logistical issues.

6) A cultural shift in mind-set is needed from the vessel operators to enable the LO to deliver more sustainable fisheries.

First, reasons to be optimistic about the economic impact of the LO: On the likely economic impacts of the discard ban, they can be broadly categorised into potential losses and potential gains. The study identified the potential losses include the following: losses associated with sorting, landing, and transporting otherwise discarded fish; foregone catches due to exhausting quotas; counting undersized fish (<MCRS) against quota; and reduced catches of marketable fish when using fishing methods to avoid quota limited species. The potential gains include those for non-human consumption outlets that can utilise and profit from previously discarded catches (Mangi & Catchpole 2014: 299; de Rozarieux 2015: 13); gains from avoiding unwanted fish, which translate into increased stock size and quotas; gains from maximising revenues from quota uplifts; gains for transport companies and storage companies that will handle the previously discarded catches; and gains associated with selling otherwise discarded fish on to the human and non-human consumption markets. The discard ban trial provides cautious grounds for optimism that the potential gains of the LO would eventually outweigh the potential losses.

The estimated loss of £122 per tonne when landing previously discarded catches assumes the participating vessels were representative of the wider fleet. This is likely a maximum, for the following reasons: 1. The ports selected were some of the furthest away from a fishmeal plant, therefore transport costs would be lower from other ports. 2. The quantities being transported did not allow for the most efficient use of lorries, since storage bins being moved were less than full - companies could collect and store material until sufficient quantity has been accumulated to make transport viable. 3. The scale of the trial was too small to allow for the most efficient use of catch handling services. Because it was a trial, one-off costs were paid to markets to deal with the material, which were higher than would be expected following implementation. 4. The previously

363 discarded catches do have a financial value and it is likely that improved efficiency in handling and
364 transport, and increased competition for the material, would evolve and improve returns to the
365 vessel operators.
366
367 There is, however, uncertainty over how much additional material destined for human and non-
368 human consumption might come ashore, because the extent to which vessel operators can adapt
369 fishing methods and alter their catch compositions is not known. Moreover, with the potential for
370 various exemptions, it is difficult to predict the levels of material and therefore the level of
371 infrastructure investment and preparedness required (transport, storage bins, physical space,
372 freezers, cold stores, and fishmeal processing plants). Moreover, small but legally-sized fish, which
373 would have previously been discarded (high-graded), will be landed for human consumption as a
374 first preference under the landing obligation, so more of it may appear on the market. However,
375 there is no indication from this study that vessel operators will be motivated to target fish below the
376 MCRS, owing to the large price differential between the human and non-human consumption
377 markets.
378
379 The potential gain to the fishing industry from the LO is mostly associated with the adjustment in
380 quota, whereby catches previously discarded will be included in the quota whereas before they were
381 not. Therefore, there is potential for vessel operators to convert this additional quota into
382 marketable landings for the human consumption market. Taking this into account, the LO affords
383 sufficient opportunities for entrepreneurial fishers to deal with some of its challenges, *and* a key
384 determinant of the economic effect will be how the adjustments to quota are allocated to the fleets
385 at a national and international level, and the ability to access unused quota.
386
387 Second, there are serious data challenges that must be overcome for the landing obligation to be
388 successfully implemented. The quota setting and ability to achieve fish stock status objectives is

dependent on collecting accurate data on catches. In this trial, new log sheets were devised for the skippers to record all components of the catch, observer coverage was increased beyond normal practice, and the fishmeal plant provided a third source of data. These steps provided validated estimates and high confidence in the catches from the participating vessels, but this is not normal practice.

It is recognised that commercial catch data may be inaccurate, because of inaccuracies in skippers' reporting but also in estimates of discards which are based on scientific observations made on a relatively few fishing trips; and while skippers are required to record discard amounts, these data are not considered sufficiently accurate to be applied (STECF, 2013). In the implementation of the LO, the level of actual discards may therefore be different from estimated levels. If the actual levels of discards are higher than the estimated levels, the fleet will need to avoid more of the previously discarded fish to prevent an economic impact. If the actual levels of discards are lower than estimated, the fleet can simply convert the quota uplift to saleable fish through more fishing effort. Moreover, the effect on the individual vessel operator will be dependent not only on the level of discrepancy between estimated and actual discard rates for the vessel, but also the distribution of the quota across the fleet.

The expectation of the LO is for changes in selectivity by vessel operators. *However*, any differences in reported levels of unwanted catches when the LO takes effect, compared with the current estimates, could be due to, either poor estimation of these catches before implementation; or to low compliance with the LO; or to changes in selectivity; or to changes to the stock structure and composition of catches. To enable accurate assessment of the status of the stocks, it will be essential to know which of these factors are operating. One of the anticipated benefits of the reformed CFP is the improved catch data, however there is currently no agreed approach on how catch monitoring will be achieved. The LO will necessitate changes in data collection and data use; there is a risk that if

415 the quality of the data on catches after the implementation of the LO deteriorates, then the quality
416 of the stock assessments and the confidence in the quota advice will be reduced.
417
418 In the UK, monitoring of total catches is easier for over-10m vessels than for under-10m vessels,
419 because the over-10m vessel e-log system can record all components of the catch. In this trial, over-
420 10m vessel catches were recorded using the existing prior-to-landing notification and e-log books;
421 but because some technical problems were encountered, we recommend that robust testing of the
422 system is done so skippers can have the tools to record their full catch. For the UK under-10m sector,
423 recording full catches was a challenge. Currently, no prior-notification of landing or the use of log
424 sheets is required. Skippers stated it was logistically difficult to produced catch data at sea, and with
425 vessels working close inshore, it was not practical to give prior notification of landing. It is
426 recommended that work be undertaken to determine how new self-reporting tools, independent at-
427 sea observations, and registered sales data can be integrated to deliver data on the full catch taken
428 by vessels where electronic reporting is not currently required.
429
430 Third, enforcement of the landings obligation will require new modes of management: Data
431 collection to drive stock assessments is directly linked with compliance with quota restrictions. In
432 this trial, the skippers participated voluntarily, there were no sanctions for not meeting the terms of
433 the simulation, the data generated provided confidence in the reported catches, and so compliance
434 was high. However, without adequate enforcement, the incentive framework to successfully deliver
435 the LO will be absent (NSAC, 2013; STECF, 2013). *According* to skippers in this trial, the landing
436 obligation will be extremely difficult to enforce, because there is little incentive to bring ashore and
437 record previously discarded catches.
438
439 New methods are needed to monitor total catches, including remote electronic monitoring (REM)
440 and validated self-sampling schemes. Several studies have testified to the success of REM. For

example, McElderry (2014) reported positive results of electronic monitoring to enforce a discard ban on the US Pacific shore-based whiting fishery, while the MMO (2012; 2013) found that REM was effective in verifying total catches in a trial with 15 English vessels. While some skippers in this study stated that having cameras on board was the only approach that would ensure compliance, others had reservations and were fearful that UK-vessel operators would be disadvantaged relative to those from other countries. Placing more emphasis on the business benefits of accurately recording catches to improve management and therefore fishing opportunities, should be part of a strategy to implement the LO.

Fourth, the problem of quota inflexibility must be resolved: In agreement with previous studies, quota restrictions are a key driver of discards (Catchpole, 2012; Condie et al., 2014a; STECF, 2014; García et al., 2016; Poseidon, 2013), and quota inflexibility is a serious risk to implementing the LO. To avoid substantial adverse economic impacts, it will be important to eliminate the so-called 'choke species' problem (NSAC, 2013; STECF, 2014; McIlwain, 2015). Quotas are shared between EU countries, whereby for each stock a different fixed percentage allocation per EU country is applied, known as the relative stability key. EU countries can exchange quotas, and the distribution of quotas at the national level is determined by each EU country. The highest risk of a choke occurs when a nation receives a low relative stability share of a species and the discard rate of that species in that nation's fisheries, is higher than the average for that stock. Continued and increased national and international movement of quota will be an essential tool to off-set these disparities and enable continued fishing in these cases. As part of the reformed CFP there is provision under Article 15, paragraphs 4a and 4b, for inter-annual and inter-species quota flexibility subject to strict conditions. It is recommended that work be done with actors who manage quota, such as the UK Producer Organisations, and fisheries managers to identify mechanisms that will ensure the highest levels of flexibility in quota usage both internationally and domestically.

467 Fifth, dealing with the unwanted catch at sea and on land raises several logistical issues. Dealing
468 with the unwanted catch at sea will be difficult. For example, the CFP agreement means that
469 undersized fish must be stowed separately from fish over the minimum conservation reference size
470 although not sorted by species. However, separate species' weights do have to be recorded, which
471 will increase the time needed to sort the catch, either on the vessel or ashore. Participating skippers
472 noted that the LO may affect fishing operations and health and safety implications making it
473 necessary to modify the layout, sorting processes and storage areas on board vessels.
474
475 Issues were also highlighted with landing the additional material, in terms of additional transport,
476 space requirements and refrigeration. Finally, a key observation from the trial was the resource
477 required to organise and monitor the collection and delivery of the otherwise discarded material. Of
478 course, many of these problems, such as the additional sorting, the challenges in handling and
479 storing material both on the vessel and at the point of landing, will discourage vessel operators from
480 catching and landing unwanted material, which is precisely the aim of the LO.
481
482 Sixth, a cultural shift in attitude and mind-set is required to make the landing obligation work: It has
483 been noted that the LO will require behavioural and institutional change, not only from the fishing
484 sector but from fisheries managers, control authorities and fisheries scientists (NSAC, 2013). As
485 Johnsen and Eliasen (2011) point out, "in the end the success of the system depends on the fishers'
486 willingness to comply", which in turn depends on "how legitimate and rational the fishers regard the
487 system to be", and whether they are prepared to undergo a cultural shift in attitude and mind-set.
488 One cultural attitude that needs changing is the reluctance of some fishers to make use of selective
489 gears. While historically, the risks of losing marketable catches when using more selective designs
490 may have dissuaded fishers, this must now also be *viewed* in the context of lost fishing opportunities
491 if quota becomes exhausted and the ability to convert previously discarded catches into quota for
492 marketable fish. By altering catch compositions through changes in selectivity it is possible to reduce

493 catches of small, low value size classes and the most restrictive species to increase profits from
494 available quota. Gullestad et al (2015) reported that the experience of Norway was that the discard
495 ban itself brought about the change in fishers' behaviour needed to make it work.
496
497 A second cultural shift needed is for fishers and fishery managers not to exploit as loopholes the
498 various exemptions provided by the European Commission, such as the *de minimis* concession.
499 STECF (2013) drew attention to the subjective nature of the criteria within the *de minimis* rules -
500 disproportionate costs and difficulty of selectivity - warning that used irresponsibly, the *de minimis*
501 rule could lead to overexploitation above MSY, either when *de minimis* levels are set too high or if
502 they are not monitored and exceed the agreed levels.
503
504 A third cultural shift that must occur is the ending of hostility by port authorities to landings of
505 unwanted catches. Market managers wanted to improve the quality of fish and did not want low
506 value fish on the market. This reluctance will need to change, but it will only do so when managers
507 see that there is a value associated with unwanted fish and that there are potential opportunities for
508 new business with this material. There is evidence that more positive attitudes are emerging (de
509 Rozarieux, 2015).
510
511 5. Conclusion and recommendations
512 This study has conducted a discard ban trial in English waters to simulate the implementation of the
513 landing obligation which was introduced under the new EU Common Fisheries Policy. The main
514 finding of the study is that while the LO is a very challenging requirement for the fishing industry to
515 meet, there are steps that can be taken to minimise the risk to fishers and maximise that chance of a
516 successful implementation of the LO, provided the following *five* recommendations are adopted.
517

1. Work should be conducted to ensure that the safety of fishers is not compromised by the LO. In particular, the effect on vessel stability, additional trip hazards on deck and sorting injuries for crew, should be assessed and guidance to vessel operators provided.

2. Catch data should be analysed in real-time from vessel reporting systems, markets, and independent observations so that catch rates and quota availability can be monitored allowing fishing businesses to plan their activities. Specifically, robust testing of the catch recording (e-log) system should be conducted so skippers have the tools to record their full catch. For sections of the fleet where log books are not required, work should be undertaken to determine how new self-reporting tools, independent at-sea observations, on shore monitoring and sales data can be integrated to deliver full documentation of catches.

3. Work should be done with POs and fisheries managers to identify mechanisms that will ensure the highest levels of flexibility in quota usage, both internationally and domestically.

4. Preparations should be made for the likelihood that more small, but legally-sized, fish will be put on to the human consumption market, and *that more storage and transport facilities will be needed for* material destined for non-human consumption at ports.

5. Efforts must be made to change mind-sets which are currently hostile to the LO through stronger links between stakeholder groups and fishery managers as part of the regionalised EU fisheries management process, to ensure that the industry has knowledge of all available tools to help them successfully transition to the LO.

538

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